Virtual Beef

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Fabric-Covered Structures for the Cold Housing of Livestock

Harold House, Agricultural Engineer, Ontario Ministry of Agriculture and Food and Ministry of Rural Affairs

Fabric-covered buildings have been around for a long time. They have become an accepted alternative for machinery storage, hay storage, and livestock housing (Figure 1). They can provide a low cost cold housing alternative to conventional housing provided producers are aware of the differences and prepared to work with them.

Many producers consider fabric-covered buildings as an alternative to conventional housing, because they feel that they are a lower cost option, bright, airy and well-ventilated. These things can be true if designed and managed properly, but producers need to understand what the limitations are and how to work with them.

Ministry of Agriculture and Food
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Lower Cost

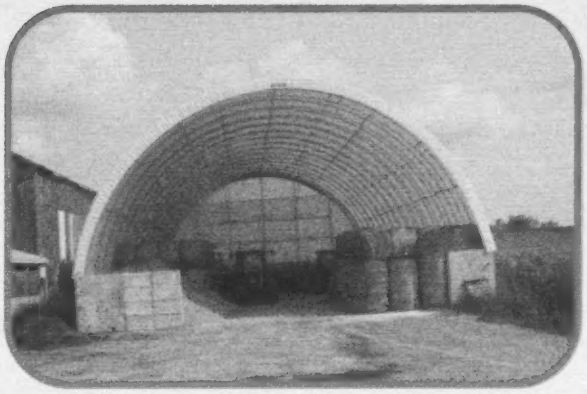

Figure 1. Fabric-covered buildings have multiple uses

Probably the number one reason why producers consider fabric-covered buildings is because they believe they are a lower cost alternative to conventional post frame buildings. If you are considering one based on cost make sure you do an "apples to apples" comparison. A fabric-covered building is not the same as post frame or stud frame building. When calculating the cost of a fabric-covered building make sure the cost includes the complete structural package including, end walls, doorways, and ventilation options. End walls and doorways are sometimes missing from a quotation. Other things like site preparation, foundation, and setting up the structure need to be considered, but that should be part of the costing for either structure.

Insulation

The other item that can be quite different when comparing the two structures is insulation. Producers often overlook the fact that fabric-covered buildings are NOT insulated. They are a cold environment barn. It is very easy to add a minimal amount of insulation under the roof steel of a conventional building to reduce condensation, at a nominal cost. Fabric-covered buildings are not insulated, therefore they will drip. On a cold clear night frost will form on the underside of the fabric, and when the sun comes out in the morning, the frost will melt and drip on whatever is below. This usually only lasts for 20 to 30 minutes, but if you can't put up with this annoyance don't consider an uninsulated building.

Bright and Airy

Producers like the fact that fabric-covered buildings are bright and airy. The light and openness of the buildings have the appeal of being in the "great outdoors". The most common colour of fabric used today is white. Clear fabric lets more light in, which is nice during cold weather, but then the building heats up too much in the summer. The white fabric allows ample light in both winter and summer, without the building heating up too much during hot weather.

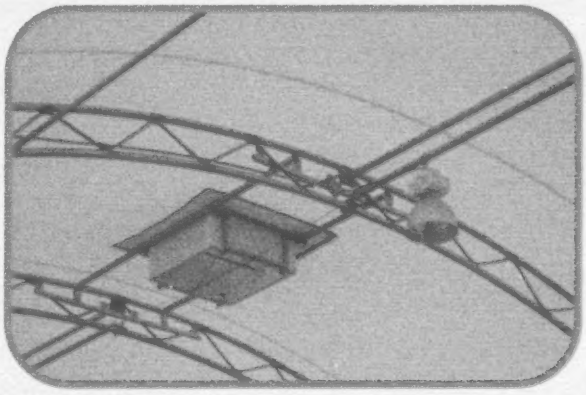

Figure 2. Chimneys for exhausting stale air

A building can be open without being well-ventilated. Because of their shape, fabric-covered buildings have lots of air volume, which does help with ventilation, but in order to be ventilated properly they need air inlets and air exhaust opening, just like any other livestock structure. If a fabric-covered building is to be used to house livestock it will need adjustable openings on both sides, usually in the form of curtain walls, and exhaust openings in the peak, usually taking the form of chimneys, or possibly an open ridge. The only exception would be a smaller fabric-covered structure that is less than 100 ft long. A shorter fabric-covered structure can be ventilated successfully end to end using end opening doors for hot weather and shade cloth in the gable ends during the cold months of the year. Shade cloth breaks the force of the wind and allows air to filter through. It is a good idea to cover the shade cloth in the gable ends with an adjustable curtain to

control the amount of opening.

The fabric-covered structures are often installed on posts, so that the straight wall of the posts can be used to provide the adjustable curtain inlets. The chimneys should be sized to provide about ½ ft^2 of chimney opening for every 100 ft^2 of floor area for exhausting stale air (Figure 2).

Maintenance

Producers are concerned that the fabric will wear out over time and need to be replaced. This is not much different than a painted steel roof that will need repainting down the road. However, it is important to keep the fabric taut. The roof material is held in place with belt tighteners. It is important to keep the fabric under tension, so that it doesn't move and wear on the support frame. It is also important to repair any mechanical damage as soon as it happens. If the fabric is ever punctured or torn by a front end loader or something else, it is important to repair the hole or tear with special tape so that it doesn't get worse. Wind can cause a small tear to increase rapidly.

Due to their size and shape, fabric-covered buildings are subject to wind loads, especially uplift. It is important to have the support posts anchored properly, and the frame bolted to the post properly so that the post does not lift from the ground, or the frame from the post.

It is also important to clear away the snow that slides off the roof away from the sidewalls. If the snow is allowed to accumulate too high on the sidewalls it may cause extra lateral loading that the structure was not designed for. Snow along the sides may also block ventilation.

Summary

Fabric-covered buildings can provide a low cost alternative for livestock that can be housed in a cold environment, provided the producer knows the limitations and how to work with them. Properly designed, they provide a bright airy well ventilated environment that can be a pleasure to work in.

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Fetal Programming of Beef Cattle

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Beef improvement programs have traditionally focused on genetic selection. Recent advances in genomics has accelerated selection by allowing us to identify key differences the DNA of an individual animal's DNA sequence. Wow! - being able to "look" right into an animal's DNA. You'd think that there can't be much left to discover in the field of genetics. But as we understand more of the science, additional complicating factors are coming to light.

Genes and the Environment

The standard view of how an animal's performance is determined takes into account 2 main factors:

1. its genetic makeup
2. the environment it is in, including nutrition, housing, climate, disease etc.

The expression of the animal's genes, interacting with its environment results in its performance for each trait. For beef cattle production, the traits we are interested include birth weight, growth rate, feed efficiency, carcass attributes and fertility, among others. But we are finding out that the expression of those genes is highly variable.

One of the foundation principles of modern genetics is that an animal's genes set its ultimate potential to perform in any given environment. For example, a feedlot steer on a given plane of nutrition can perform up to a maximum level set by its genetic makeup. If its environment during the feeding period is optimum (including health status, adequate bedding and space, freedom from stress etc.) then the steer's performance will only be limited its genetic potential. And since genetic makeup is determined at conception, its future potential is set "in stone", and would only be affected by the environment at the time the trait was expressed. Or is it?

What is Fetal Programming ?

Recent research shows that the future performance of an animal can be affected by the maternal environment of the fetus during its early development. And this may occur even though traits expressed by the newborn animal, such as birth weight, are unaffected! This concept is called fetal programming, and has important implications for beef production systems (see Figure 1)

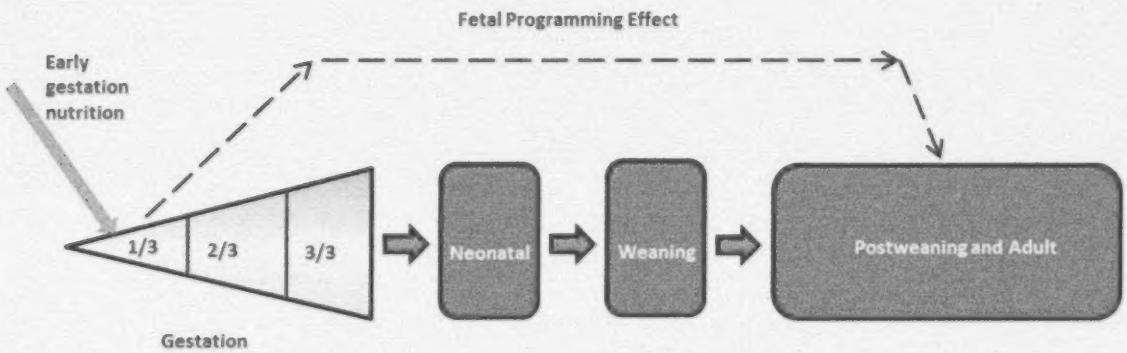

Figure 1: Schematic of the Principle of Fetal Programming

For example, the weight and body condition of pregnant cows, which affects fetal nutrition, is dramatically impacted by the plane of nutrition. This plane can vary from year to year on the same farm, depending on the growing and harvesting conditions for the forages which make up the

majority of most beef cow diet. As well, the seasonality of the beef cow production cycle sees major diet changes, as many cows transition from grazing to stored feeds during early gestation. The need for additional dietary feed energy as temperatures decline from fall into winter further complicates things. The end result is that pregnant cows often undergo significant changes in body weight and fat level during the course of gestation, and these changes can vary from year to year. While we know that major changes in the level of energy and protein in the diet of cows in late gestation can affect the birth weight, vigour, and health status of the newborn calf, new research if finding that, contrary to the traditional view, cow nutrition in early gestation may, have an impact on traits exhibited much later in the calf's life. And, in addition, dietary differences in late gestation which are not large enough to affect the neonatal calf may exert an influence much later in the animal's life.

A study from Nebraska looked at the effects of protein supplementation of grazing, late gestation cows on the performance of their heifer progeny. Heifer calf birth weight was the same for both supplemented and unsupplemented groups, showing that the difference in nutrient supply was not great enough to have an impact on fetal growth. However, the heifer calves from supplemented dams had greater weaning weights, prebreeding weight, weight at pregnancy check and, most importantly, better pregnancy rate. This pregnancy rate difference was quite large, with heifers from non-supplemented dams at 80% while that for heifers from supplemented dams were 93%. And the heifers from supplemented dams had a 28% advantage in the number of calves born in the first 21 days of the calving season. All this occurred even though postweaning gain and feed intake was the same for both groups of heifers. So in this study, a fetus developed in a uterine environment which benefited from additional protein exhibited a major economic advantage a year and a half after being born, although no differences were apparent when they were newborn calves!

A long term study in Montana provided 2 dietary levels (classed as either marginal or adequate) to pregnant cows. These cows were winter grazing (Dec – Mar) and supplemented with various harvested feeds. Heifer calves from these cows were then developed on 2 dietary levels during a 140 day period after weaning, giving a total of 4 management groups. The high level diet was fed to appetite and resulted in a heifer growth rate of 1.5 lbs/day. The low level diet was fed at 80% of appetite and gave a growth rate of 1.15 lbs/day. In the winters after their first breeding season, each feeding group was maintained, with restricted heifers fed the marginal diet after they became cows and the full feed heifers placed on the adequate winter diet. The performance of heifers through their first breeding season showed the expected effects of postweaning diet level on growth, carcass and reproductive performance (higher growth rate heifers had superior performance), but there were no effects from the nutritional treatment their dams had been on.

However, measures taken later in life showed effects did relate to the maternal environment they developed in. Female progeny from the dams which were fed the lower quality diet had heavier body weights at 5 years of age, whether they were placed on the high or low level postweaning and winter diet. Female progeny from the dams which were fed the high quality diet, and were then placed on the low quality diet themselves had the lightest body weight and lowest condition score at 5 years of age. And the females from the dams fed the lower quality diet and then fed on the lower nutritional plane during development and the following winters had significantly lighter birth weight

progeny than all other groups, although they also had the second highest body weights at 5 yrs of age. Something about being nutrient restricted as fetuses carried forward to their performance of adults, independent of how they were fed after weaning. And females which were from high level dams and then went into the restricted dietary group had a lower body condition score at 5 yrs than all other dietary combinations.

What about feedlot performance of progeny from nutritionally restricted dams? Research from Ohio (Underwood et al.) with pregnant cows on either native or improved pasture found that although the birth weights of male calves were not different between groups, steers from improved pasture dams had greater weaning weights, feedlot gain, carcass weight and fat level.

These and other results have stimulated scientists to take a closer look at the possible mechanisms behind fetal programming. Although 75% of fetal growth occurs during the last 2 months of gestation, and we have generally focused attention on cow nutrition during this phase, the early nutrition of the fetus seems to be important in influencing performance far into the future. This is likely associated with the early development of the placenta, especially the degree of blood vessel development. Although most of the fetal mass is deposited late in gestation, critical aspects of development such as the differentiation of cells and the start of organ formation are occurring at a much earlier time. This makes nutrition of the dam early in gestation much more important than previously thought – contrary to our tradition of treating them as having minimal nutrient requirements.

While our understanding of fetal programming in beef cattle is at only a rudimentary level, it looks like a promising area. Hopefully, we will eventually be able to recommend feeding strategies for pregnant beef cows which takes into account the effect of fetal programming on the future performance of both feedlot animals and females that are retained in the breeding herd.

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[ii]Martin et al. 2007. J. Anim. Sci. 85: 841-847
[iii]Roberts et al., 2009. J. Anim. Sci. 87: 3043-3042
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Upcoming Events

2013 Ruminant Feed Industry Day is a one-day program designed to present feed industry personnel including sales staff, nutritionists and other interested professionals with timely information and tools to help their ruminant livestock clients. For more information.

Forage Focus 2013 – Maximizing the Value of Good Forages

Wednesday November 27th – Winchester and Thursday November 28th – Shakespeare

Marketing Dashboard

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A marketing dashboard is similar to a dashboard in your pickup truck. The truck dashboard provides you with a number of gauges, displays, and controls. These are used to monitor the performance of your truck to make decisions while driving (current) and to maintain (future) it in good working condition. Similarly, a marketing dashboard contains items to monitor the current marketplace and to assist in making future marketing decisions. The items (gauges) in a farm's marketing dashboard will vary and can be personalized depending on the farm business's needs. A few marketing gauges (dashboard items) to consider are highlighted in this article.

Look Forward at Prices

Having a look forward at prices is an important tool to have. Figure 1 provides the snapshot of the prices to-date in 2013 (green bars) and estimated prices (red bars) for the coming year. Also, the current prices can be compared to the five (5) year average prices (black line). This gives a seasonal price trend pattern comparison.

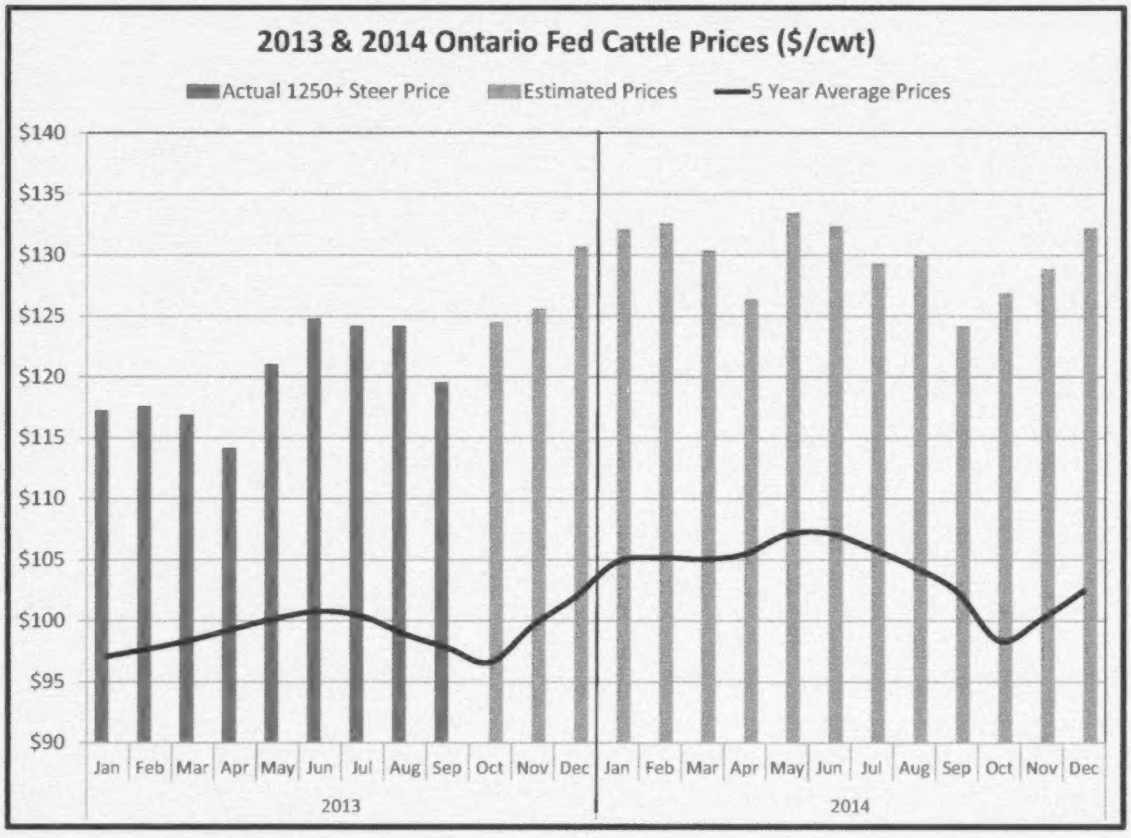

Figure 1: Ontario Fed Cattle Price Trend

The actual 1,250+ steer prices are based on the weekly reported prices by the Ontario Cattlemen's Association. The estimated prices are based on the closing Chicago Mercantile Exchange (CME) Live Cattle Futures and Canadian Dollar Futures on October 4, 2013 and an estimated monthly

three year average basis (see "Monitor Basis" section). It is important to remember this is only a snapshot (point in time) of the expected prices. As the market place reacts to new and changing market information, the futures and local cash prices will move accordingly.

A forward looking price can be used to look at "what if" situations, estimate returns over feed and replacement cattle costs, or estimate net returns after all costs (in a Cost of Production calculator). If returns are favourable, major costs are controlled, the risks are considered and a forward pricing opportunity is available, a decision can be made and action taken.

Here is an example of how to calculate a forward looking price. Market information available (based on closing futures October 4, 2013) is April 2014 Live Cattle Futures US$135.45 per cwt.; June 2014 Canadian Dollar futures $0.9649: estimated basis of -$9.88 per cwt. (the two thirds basis range is minus $14.47 to minus $5.29 per cwt.)

Live Cattle Futures (US$/cwt.) ÷ Canadian Dollar Futures (C$/US$) – Estimated basis (C$/cwt.) = Estimated Forward Cattle Price (C$/cwt.)

$135.45 ÷ $0.9649 - $9.88 = $131

(Range would be $126 to $135 per cwt. using the estimated basis range provided)

Based on the Live Cattle Futures on October 4, 2013, the estimated price for fed cattle in March 2014 was in the range of $126 to $135 per cwt. with an average of $131 per cwt.

Monitor Basis

The Ontario Fed Steer Basis is the difference between the 1250+ pound steer price in Canadian dollars minus the nearby month Live Cattle CME Futures in Canadian dollars (futures ÷ exchange rate). Figure 2 compares the three year average basis (2010 to 2012) to this year's basis to-date. The weekly average basis calculated by Canfax is used to calculate the simple monthly averages.

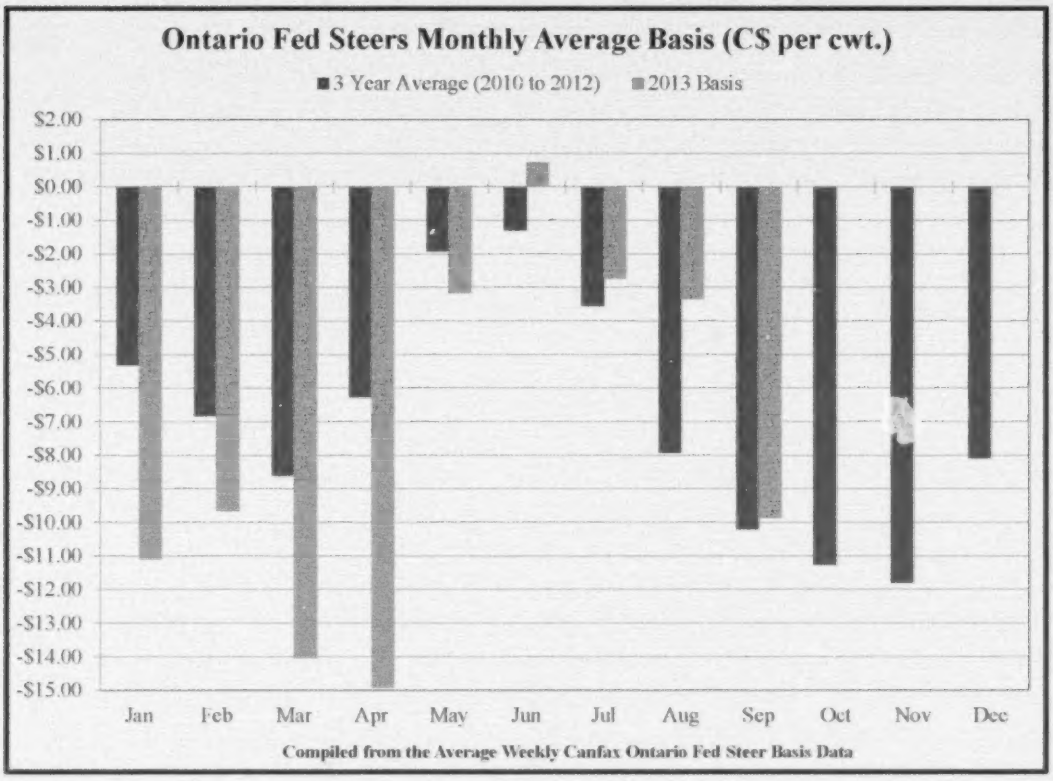

Figure 2: Monthly Average Basis

Basis is impacted by exchange rate, local supply and demand, marketing costs (i.e. transportation costs), and government policies. The seasonal pattern as demonstrated in the graph shows a stronger basis in the summer months with the basis weakening through the fall and winter months. A point to keep in mind is that basis will vary every year as demonstrated by comparing this year's basis (2013) with the three year average basis (2010 to 2012). Consideration has to be given to the impact that basis may have on pricing decisions that are made. For example, in April, if marketing decisions were based on the expected basis of minus $6.00 per cwt. and the marketing conditions ended up with a minus $15 per cwt. basis, this could mean a $130 ($9 x 14.5 cwt.) difference in income per head. If a standard deviation for the monthly or weekly basis is available, it can be used to develop an expected range of estimated prices.

Basis can be used to estimate forward looking prices as discussed under the "Forward Looking Price Section". Also by monitoring current basis compared to a historical basis and an expected seasonal basis trend can be used to make decisions on basis contracts being offered.

Develop Market Intelligence

This involves pulling together marketing resources to build your market knowledge base to assist in making timely marketing decisions. There are numerous marketing information resources available for producers to use from simple market price reports to in-depth trend analysis. Market information includes market prices, fundamentals, analysis, outlook, and strategies. Understanding the market fundamentals helps to make informed marketing decisions to capitalize on market pricing

opportunities. The key is to utilize resources to help you build your market intelligence to make informed decisions. Three questions that information should assist in answering are:

- What is the potential market impact on your risks? (i.e. price, margin, cash flow and financial risks)
- Which is greater- the factors that could cause the markets to rise or to fall?
- Are there input or output pricing opportunities?

Determine Cost of Production

The market place does not care what your cost of production is. But knowing your cost of production helps to realize what a "good market price" is for your farm business to realize its marketing goals. Calculating the cost to produce a finished steer will give one more piece of information to use when making marketing decisions for inputs and outputs.

The first step is to develop a breakdown of your costs that suits your records and decision making process. Figure #3 an example based on data from the weekly breakeven reports done by the Ontario Cattlemen's Association (OCA). This is a situation of purchasing an 850 pound yearling steer to be fed for approximately 183 days and finished at a weight of 1,450 pounds.

Item	Weight (lbs)	$/cwt.	$/Head	$/cwt.
Market Steer	1,450	$130	**$1,885**	**$130**
Yearling steer	850	$150	**$1,275**	**$88**
Feed	**Tonnes**	**$/tonne**		
Corn Silage	1.21	$41	$49	
Corn	1.79	$172	$308	
Supplement	0.13	$404	$53	
Total Feed Cost			**$410**	**$28**
Yardage (health, interest, marketing, etc.)			$153	$11
Total Costs			**$1,838**	**$127**
Net Return			**$47**	**$3**

Figure 3: Cost of Production Calculator

This simple calculator (spreadsheet) with some interactive input data provides a quick and easy method to do some "what if" situations. In the above calculator, all of the bold green numbers can be changed and all the other numbers are formulas. Quickly you can input some numbers to determine what price ranges are needed to realize the returns your farm business needs. Knowing your cost of production helps to establish target prices to recognize acceptable market prices that are compatible with your financial situation.

These are just four examples of "gauges" that could be part of a "Marketing Dashboard". The "gauges" help to monitor, add discipline and hopefully take some of the emotion out of making marketing decisions. A "Marketing Dashboard" can be a handy farm business management tool to facilitate the successful marketing of your production.

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Beef Cattle and Greenhouse Gas Production - a new United Nations Report Reduces Bovine Contribution by 22%

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What Are Greenhouse Gases?

Solar radiation provides most of the heat energy which warms the Earth. Some incoming radiation is reflected by the atmosphere, a small amount is absorbed directly by the atmosphere, and rest strikes the Earth's surface. Part of this incoming radiation is absorbed by the Earth and then re-emitted back into the atmosphere in a form which can be absorbed by atmospheric gases such as water vapour, carbon dioxide and methane. These gases in turn release the energy back into the atmosphere, helping to warm the planet. The gases involved in this are called the "Greenhouse Gases" (GHG). While the Greenhouse Effect is a natural phenomenon, human activity has increased the levels of some GHG well above historic levels, causing a significant warming trend on a global basis.

The 2006 FAO Report

In 2006, the Food and Agricultural Organization (FAO) of the United Nations released a report on the role of animal agriculture in greenhouse gas (GHG) production, called "Livestock's Long Shadow". The FAO report concluded that livestock were responsible for 18% of all human related GHG production. This conclusion generated a lot of bad press for livestock, and especially the beef cattle sector. However, when independent scientists reviewed the report, many took issue with both the methodology employed and the conclusions. For example, Dr. Frank Mitloenher of the University of California (Davis) stated that when only the GHGs directly contributed by cattle and pigs in the U.S. were considered, livestock account for only about 3% of all greenhouse emissions. So it's important to look behind the executive summaries of these reports to fully understand their implications.

How were these very different conclusions drawn from the same data? In reaching their conclusion regarding livestock, the FAO had included a number of GHG sources which were not directly related to the animals, such as the conversion of forested land in South America to agricultural production, the processing of meat, and the transportation of product to consumers. While all of these are important sources of GHGs, we need to be careful we understand how they are being allocated. For example, as the human population continues to expand, land will continue to be converted from

forest to food production, whether for crops fed directly to humans or though livestock first. And production systems vary dramatically depending on what region of the world you are looking at. So we also need to consider the results from a North American production system standpoint, in order to understand their relevance to our conditions.

The 2013 FAO Report

The FAO has published a new report on livestock's contribution to GHGs, titled "Tackling Climate Change Through Livestock". This report continues their methodology of attributing a wide array of GHG emissions to livestock production. In this report, livestock's contribution to the total of human source GHGs is 14.5 %, which is a reduction of about 20% reduction from the 2006 report. While this is welcome news, we still need to take a more in-depth look at the data understand where this conclusion comes from and how it applies to us.

Cattle are an important component of total livestock GHG production, due primarily to the amount of methane produced by microbial activity in the rumen. The FAO model estimates that on a world-wide basis, beef cattle account for 41% of total livestock emissions, with dairy cattle at 20%.

Beef Cattle Sources of GHG

The primary GHGs associated with cattle are methane, carbon dioxide and nitrous oxide. The relative contribution of various aspects of beef production on a worldwide basis is shown in Table 1. The major source of emissions is the rumen, from methane produced by microbial activity, followed by emissions from manure. The conversion of forest to pasture land is relevant only to Latin America and is occurring primarily in Brazil. It's important to note that the land conversion component of the FAO model is quite weak, with the 95% confidence interval for the effect being plus or minus 50%.

Table 1. Sources of Beef Cattle GHG Emissions (FAO 2013)

Rank	Source	Proportion of Total
1	Enteric (rumen)	43%
2	Manure (applied and deposited)	18%
3	Conversion of forest to pasture	15%
4	Feed	10%
5	Fertilizer and crop residues	7%
6	Manure management	5%
7	Energy usage + post farm	1.5

Regional and Production System Differences

The FAO report looked at the differences in GHG emissions from both different production systems and different world regions. Since the type of system used is determined in part by the climate, the regions and systems tend to be interrelated. The comparison was based on the intensity of emissions, which was measured as the kg of CO2 equivalent produced per kg of carcass weight. A selection of results by region is presented in Table 2.

There is a wide variation among regions for emission intensity. For example, beef production in Latin America produces 72 kg of CO2-eq per kg of carcass weight, while the rate in North America is less than 40% of this. Some of this difference is due to animal production efficiencies – for example, systems where cows are weaning a calf every year produce less GHG per unit of output than those producing one calf every 3 years. Another part of the difference is due to degree to which grasslands are part of production. In general, more extensive systems were found to produce more GHG per unit of output than intensive systems. However, this is another weak area in the FAO model, as scientists do not agree on the baseline impact of grassland production on GHG emissions, so it was omitted from the calculations. This is an important issue, as grasslands are considered by some to act as a "sink" (absorbs and stores) for CO2.

Table 2. GHG Emission Intensity for Beef Production by Region (FAO 2013)

Region	Kg CO2-eq* emission per kg of Carcass wt*
South Asia	75
Latin America	72
Sub Saharan Africa	71
North America	29
Oceania	26
Western Europe	18

*Carbon dioxide equivalent

Opportunities for Reducing GHG in Beef Production

The FAO report found that even within a region and production system, there is wide variation in the intensity of emissions – so a lot of improvement can be made within systems rather than by changing systems. In fact, the variation within a production system was almost as great as that among systems. There was an approximately 4-fold difference in emission intensity between the top 10% of producers and the bottom 10% of producers within a system.

The report used this information to predict that if all producers within a specific location/system adopted the best practises of the top 25%, GHG intensity could be reduced by 18%. And if all adopted the practices of the top 10%, GHG intensity could be reduced by 30%.

In the next issue of *Virtual Beef* we will look at how the Ontario beef industry can reduce GHG emission intensity.

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